

# Quantification of the sensitivity of NASA CMS Flux inversions to uncertainty in atmospheric transport.

*PennState University: Thomas Lauvaux, Kenneth J. Davis*

*Jet Propulsion Laboratory: Kevin Bowman, Junjie Liu*

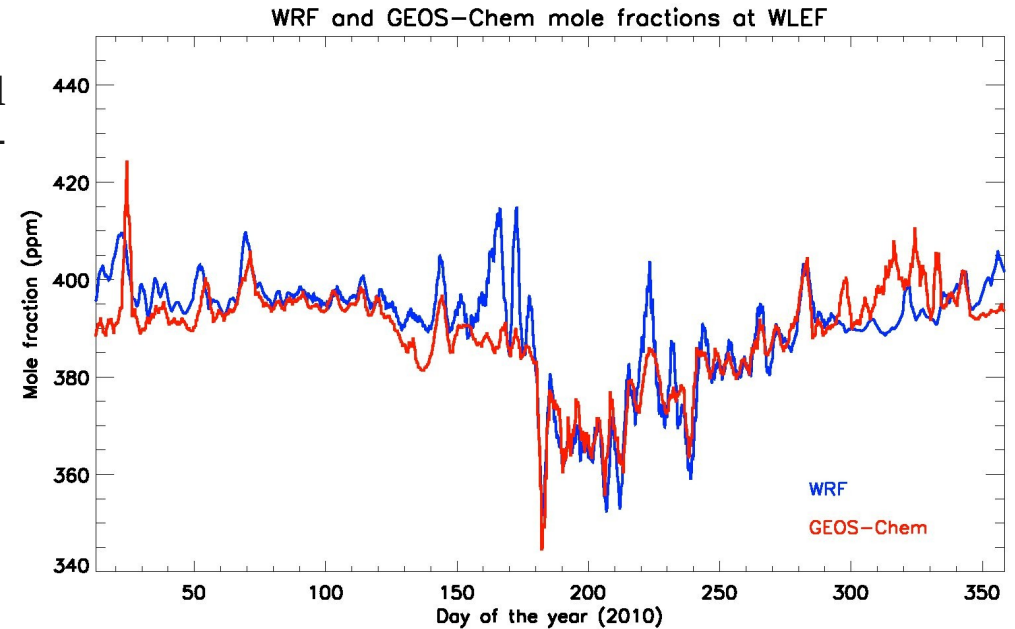
**Objective 1:** Assess the transport error in the global NASA CMS-Flux system and the mesoscale WRF-LPDM based upon meteorological data and CO<sub>2</sub> profiles from airborne measurements over North America.

**Objective 2:** Represent transport error by a physics-based ensemble of transport configurations in WRF.

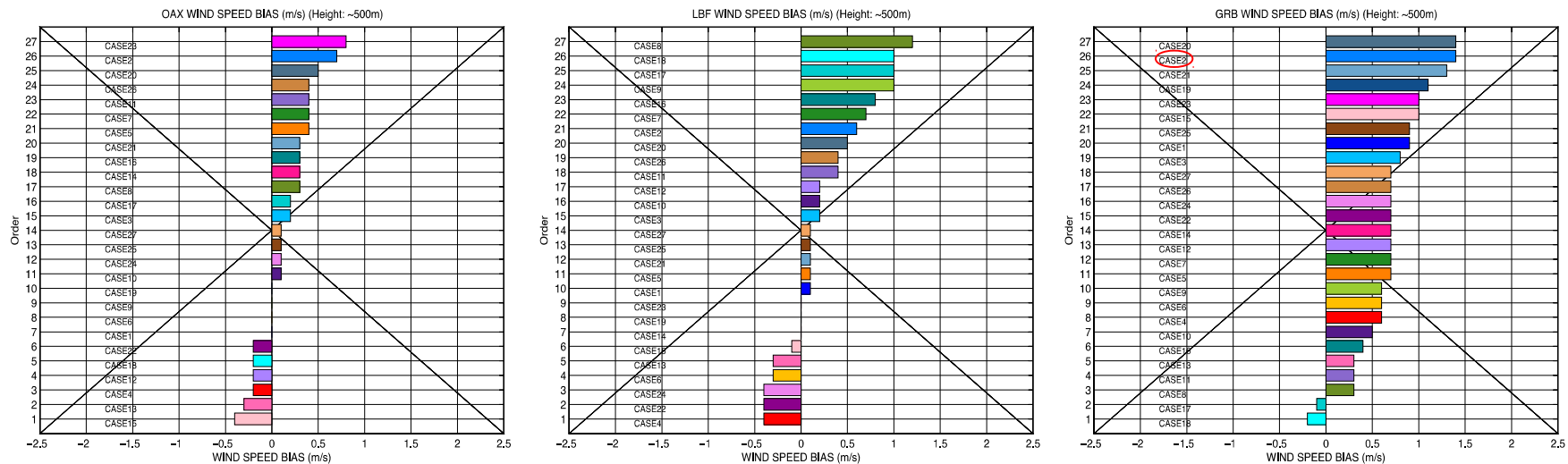
**Objective 3:** Estimate the contribution of transport uncertainty over North America on global flux uncertainty.

**Objective 1:** Assess the transport error in the global NASA CMS-Flux system and the mesoscale model WRF-LPDM.

*CO<sub>2</sub> mole fractions simulated by WRF-Chem (in blue) and GEOS-Chem (in red) at the WLEF tower (Park Falls, Wisconsin) using the CMS-Flux posterior fluxes and boundary conditions, for the year 2010. The identical configuration for CO<sub>2</sub> fluxes and boundary inflow allows to identify the differences due to the transport models only.*

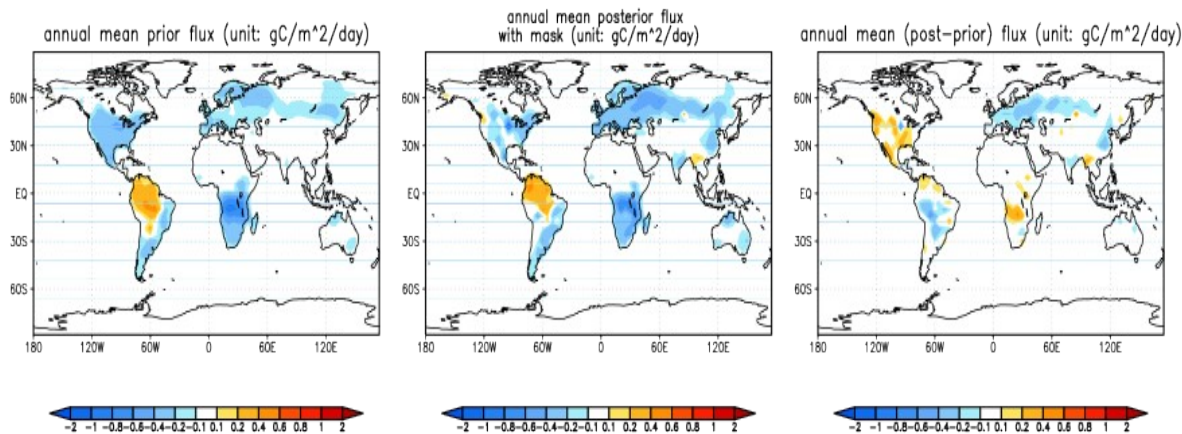


**Objective 2:** Represent transport error by a physics-based ensemble of transport configurations in WRF.

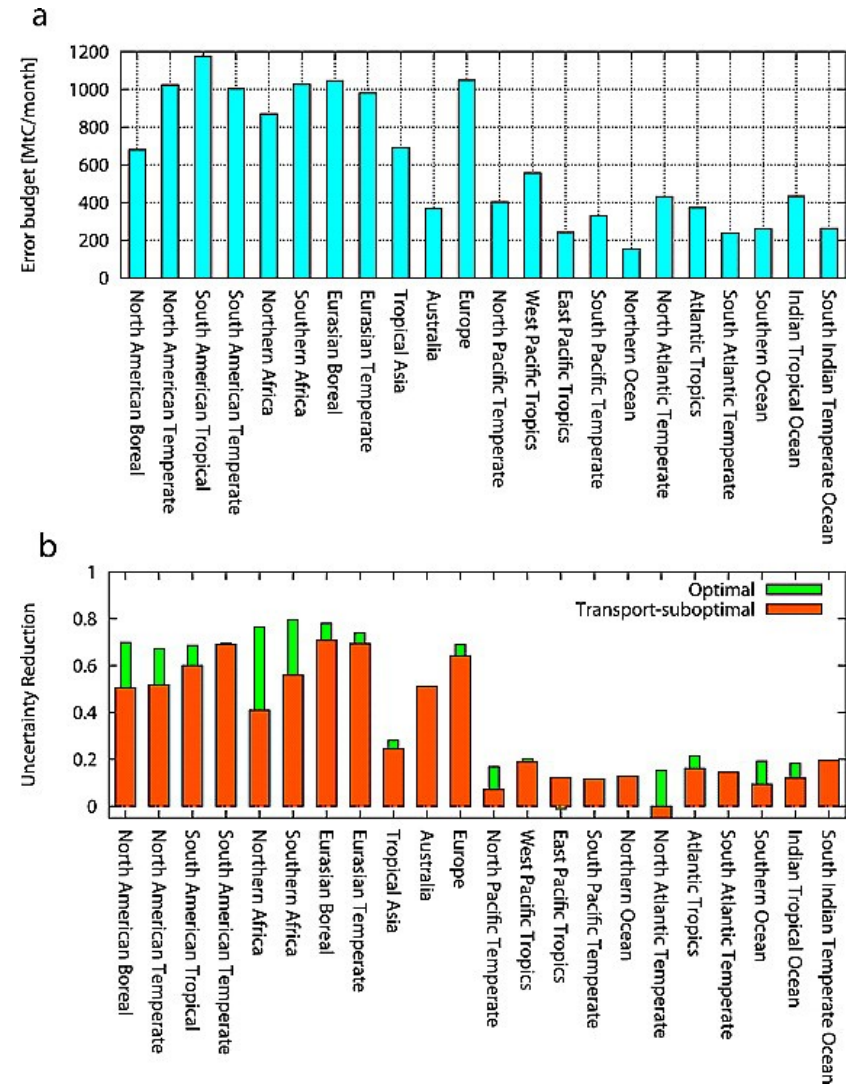


*Systematic errors in horizontal wind speed from 27 different configurations of WRF-CO<sub>2</sub> at 10km resolution compared to observations from rawindsondes located across the US upper Midwest (in m/s)  
(courtesy of Liza E. Diaz)*

### Objective 3: Estimate the contribution of transport uncertainty over North America on global flux uncertainty.



Left panel: the annual mean prior biosphere flux; middle panel: the annual mean posterior biosphere flux; right panel: the difference between posterior flux and the prior flux. (unit:  $\text{gC/m}^2/\text{day}$ ). The global net terrestrial biosphere fluxes for the prior and the posterior are  $-5.1\text{GtC}$  and  $-5.4\text{GtC}$  respectively. (courtesy of Junjie Liu, JPL)



Impact of transport model errors on error reduction for the estimation of  $\text{CO}_2$  surface fluxes from GOSAT observations (Chevallier et al., 2010).